

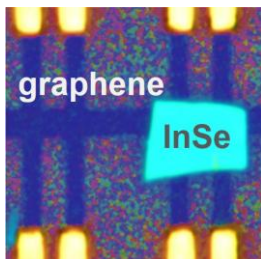
From epitaxy to science and processing technologies of novel van der Waals crystals

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The development of van der Waals (vdW) heterostructures made by stacking two dimensional (2D) crystals has led to the discovery of new phenomena and the realization of 2D functional devices ranging from sensitive phototransistors to tunnel diodes. The electronic properties of these devices can be modified not only by careful selection of the materials within the stack, but also by adjusting the built-in strain and relative orientation of the component crystalline layers. Among these vdW crystals, the metal chalcogenide InSe compound represents a new exfoliable and stable

semiconductor that expands the current library of vdW crystals. Our recent demonstration of FETs with electron mobility higher than in Si-FETs, and the observation of “giant” quantum Hall plateau and fast broad-band photodiodes has revealed the great potential of these materials. In this talk I will review the research at Nottingham on this new class of 2D layered compounds. From the growth and fabrication of vdW heterostructures to the demonstration of prototype devices, I will discuss how these layers can provide a platform for scientific investigations and new routes to 2D electronics and optoelectronics [1-5].

1. G.W. Mudd et al., *Advanced Materials* 25, 5714 (2013); *ibidem* 27, 3760 (2015).
2. G.W. Mudd et al., *Scientific Reports* 6, 39619 (2016).
3. N. Balakrishnan et al. *2D Materials* 4, 25043 (2017).
4. D.A. Bandurin et al. *Nature Nanotechnology* 12, 223, (2017).
5. Z.R. Kudrynskiy et al. *Physical Review Letters* 119, 157701 (2017).



Prof. Amalia Patanè studied at the University of Rome “La Sapienza” where she graduated with first-class honours in Physics in 1994 followed by a PhD degree in 1998. She has worked as a Research Associate (1998-2002) in the School of Physics and Astronomy of the University of Nottingham, where she conducted the first imaging by magneto-tunneling of electrons confined in a nanocrystal (*Science* 2000). As a lecturer at Nottingham (2002-06), she has developed further her research on quantum systems by exploring novel carrier dynamics in high magnetic fields (*Nature* 2004). She was promoted

Reader in 2006 and Professor of Physics in 2011. Her current research focuses on novel van der Waals two dimensional crystals (*Nature Nanotechnology* 2017; *Physical Review Letters* 2017). Prof. Patanè leads the University of Nottingham in the EU Graphene Flagship (<http://graphene-flagship.eu/>) and as a member of the Council of the European Magnetic Field Laboratory, EMFL (<http://www.emfl.eu/home.html>), she promotes the development of high magnetic field facilities and their application to study important materials in condensed matter physics. Her research achievements were recognized by the Sir Charles Vernon Boys Medal and Prize of the Institute of Physics (2007), an EPSRC Advanced Research Fellowship (2004-09) and a Leverhulme Trust Research Fellowship (2017-19). She is also a Member of the International Union of Pure and Applied Physics Commission (IUPAP, Semiconductor Commission 2014-20) and the Council Board of the EMFL (2015-20).